PATENT APPLICATION

In the application of

H. Lee MARTIN et al.

Group Art Unit: 2614

Serial No: 08/887,319

Examiner: M. Lee

Filed: July 2, 1997

Att'y. Docket: 01096.09901

For: OMNIVIEW MOTIONLESS CAMERA ORIENTATION SYSTEM

DECLARATION PURSUANT TO 37 C.F.R. 1.131

The Honorable Assistant Commissioner for
Patents
Washington, D.C. 20231

Sir:

I, Steven D. Zimmerman, declare as follows:

1. I am a joint inventor of the Omniview Motionless Camera Orientation System described in U.S. Patent Application 08/887,319.
2. Prior to and during May 1990 I was an associate at TeleRobotics International of Knoxville, Tennessee and was engaged in the design and development of a system for omnidirectional image viewing (hereinafter, the "project").
3. Exhibit A is a SBIR proposal for the National Aeronautics and Space Administration. The SBIR proposal was prepared prior to May 16, 1990, the publication date of the Japanese laid-Open Reference No. 2-127877, referred to by the Examiner in his January 2, 2001 Office Action as the Kurahashi reference. As shown on page 20 and 21 of Exhibit A, during phase 1 of the proposal a theoretical analysis was performed to develop a mapping algorithm to map a fisheye image into an undistorted object plane representation for use

with digital electronics. The resulting algorithm was validated experimentally in phase I. As described on page 20 of Exhibit A, the phase II proposal was concerned with a hardware implementation of an electro-optical pan/tilt/zoom camera system for remote viewing. The hardware implementation was to eliminate mechanical components and motion sensing devices.

4. The publication date of the Kurahashi reference, May 16, 1990, is less than one year prior to the filing date of the parent application (Serial No. 07/699,366, filed May 13, 1991, now U.S. Patent 5,185,667) from which U.S. Patent Application 08/887,319 depends.

5. Exhibit A shows conception of the elements of the claims as follows and the elements of the claims can be found in U.S. Patent 5,185,667 as follows:

Claim 1 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor for converting digital images for use in an imaging system, comprising:	Page 46, DSP in FIG. 5	Items 6 and 7 of FIG. 1 and column 3, lines 32-35
a digital data memory adapted for storing digital data representing an image having the properties of a circular field-of-view and objects in the field-of view being substantially in focus,	Pages 45 and 46 (FIG. 5, CCD Frame Buffer)	Image buffer 4 of FIG. 1, column 3, lines 30-32, and column 5, lines 13-17
a control input for receiving a signal representing a selection of a portion of the image, wherein said selection ranges across said field of view, and	Pages 47 and 51	FIG. 1 and column 4, lines 10-21
a converter, responsive to said control input, for converting stored digital	Page 53 (Algorithm Processor Block) and page 46 (FIG. 5)	Column 3, lines 32-46 and column 4, lines 48-53

data in said digital data memory representing a planar image for display.		

Claim 2 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 1, said converter utilizing an orthogonal set of transformation algorithms.	Pages 39-41	Column 2, lines 51-54

Claim 3 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 1, said converter continuously converting at the rate of a television signal.	Page 41, lines 23-25	Column 4, lines 44-47

Claim 4 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 1, said control input for receiving signals representing zenith and azimuth angles of the selected image portion.	Pages 6 and 39-40. Page 51, lines 34-37.	Column 8, lines 5-8

Claim 5 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 1, said input for receiving a plurality of signals and said converter for converting stored digital data in said digital data memory representing each selected portion to digital data representing corresponding perspective-corrected images.	Pages 6 and 39-40. Page 51, lines 34-37. Page 53 (Algorithm Processor Block) and page 46 (FIG. 5).	Column 8, lines 5-8. Column 3, lines 32-43 and column 4, lines 48-53.

Claim 6 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 1, wherein said image is received from a fisheye lens.	Page 6	Item 1 in FIG. 1.

Claim 7 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 3, wherein said rate is at least thirty images per second.	Page 41, lines 23-25	Column 4, lines 44-47

Claim 8 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 4, said input for further receiving signals representing an object plane rotation angle.	Pages 6 and 39-40.	Column 8, lines 5-8

Claim 9 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 4, said input for further receiving signals representing a level of magnification.	Pages 6 and 39-40.	Column 8, lines 5-8

Claim 10 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor as recited in claim 1, wherein said image is received from a wide angle lens.	Page 6	Item 1 in FIG. 1.

Claim 11 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method of converting a digital image for use in an imaging system comprising the steps of:	Pages 20 and 39-41	Column 2, lines 36-59
storing digital data representing an image having the properties of a circular field-of-view and objects in the field-of-view being substantially in focus,	Pages 45 and 46 (FIG. 5, CCD Frame Buffer)	Image buffer 4 of FIG. 1, column 3, lines 30-32, and column 5, lines 13-17
selecting a portion of said image, wherein said selecting step selects said portion across said field-of-view,	Pages 47 and 51	FIG. 1 and column 4, lines 10-21
converting stored digital data representing the selected portion into digital data representing a perspective-corrected image for display.	Page 53 (Algorithm Processor Block) and page 46 (FIG. 5)	Column 3, lines 32-43 and column 4, lines 48-53

Claim 12 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 11 wherein said converting step utilizes an orthogonal set of transformation algorithms.	Pages 39-41	Column 2, lines 51-54

Claim 13 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 11, wherein said converting step is repeated at the rate of a television signal.	Page 41, lines 23-25	Column 4, lines 44-47

Claim 14 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 11, wherein said selecting step comprises the step of selecting at least a zenith angle representing the selected image portion.	Pages 6 and 39-40. Page 51, lines 34-37.	Column 8, lines 5-8
Claim 15 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 11 wherein said selecting step comprises the step of selecting a plurality of portions of said image, and said converting step comprises the step of converting stored digital data representing each of said selected portions to digital data representing corresponding perspective-corrected images.	Pages 6 and 43-44.	Column 2, lines 22-24. Column 3, lines 38-46. Column 8, lines 5-8.

Claim 16 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 11, wherein said rate is at least thirty images per second.	Page 41, lines 23-25	Column 4, lines 44-47

Claim 17 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 11, wherein said image is received from a fisheye lens.	Page 6	Item 1 in FIG. 1.

Claim 18 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 13 wherein said selecting step further comprises selecting an object plane angle of rotation.	Pages 6 and 39-40.	Column 8, lines 5-8

Claim 19 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 13 wherein said selecting step further comprises the step of selecting a degree of magnification.	Pages 6 and 39-40.	Column 8, lines 5-8

Claim 20 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method as recited in claim 11 wherein said image is received from a wide angle lens.	Page 6	Item 1 in FIG. 1.

Claim 21 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method of converting a digital image for use in an imaging system comprising the steps of:	Pages 20 and 39-41	Column 2, lines 36-59
storing digital data representing a partial spherical image; and	Pages 45 and 46 (FIG. 5, CCD Frame Buffer)	Image buffer 4 of FIG. 1, column 3, lines 30-32, and column 5, lines 13-17
converting digital data representing a selected portion of the partial spherical image into digital data representing a perspective-corrected view for display, wherein said selected portion is chosen across said field-of-view.	Page 53 (Algorithm Processor Block) and page 46 (FIG. 5) Pages 47 and 51	Column 3, lines 32-43 and column 4, lines 48-53 FIG. 1 and column 4, lines 10-21

Claim 22 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor for converting digital images for use in an imaging system, comprising:	Page 46, DSP in FIG. 5	Items 6 and 7 of FIG. 1 and column 3, lines 32-35
a digital data memory for storing digital data representing an image having the properties of a circular field-of-view and objects in the field-of view being substantially in focus,	Pages 45 and 46 (FIG. 5, CCD Frame Buffer)	Image buffer 4 of FIG. 1, column 3, lines 30-32, and column 5, lines 13-17
a control input for receiving a signal representing a selected viewing angle, wherein said viewing angle is chosen from the angles varying across said field-of-view, and	Pages 47 and 51	FIG. 1, column 4, lines 10-21 and column 3, lines 39-43
a converter, responsive to said control input, for processing the stored digital data according to	Pages 47, 51 and 53 (Algorithm Processor Block) and page 46 (FIG. 5)	Column 3, lines 32-43 and column 4, lines 48-53; FIG. 1 and column 4, lines 10-21;

the selected viewing angle and outputting a perspective-corrected image for display.		Column 8, lines 5-7

Claim 23 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method of converting digital images for use in an imaging system comprising the steps of:	Pages 20 and 39-41	Column 2, lines 36-59
storing digital data representing an image having the properties of a circular field-of-view and objects in the field-of-view being substantially in focus,	Pages 45 and 46 (FIG. 5, CCD Frame Buffer); Page 35 (fisheye lens); it is well known that the prefect fisheye lens has an infinite depth-of field	Image buffer 4 of FIG. 1, column 3, lines 30-32, and column 5, lines 9-17
selecting a viewing angle, wherein said viewing angle is chosen from the angles varying across said field-of-view, and	Page 47 and 51	FIG. 1, column 4, lines 10-21 and column 3, lines 39-43
processing, responsive to the selected viewing angle, the stored digital data according to the selected viewing angle and to output a perspective-corrected image for display.	Pages 46, 53 and 54	Column 3, lines 39-48

Claim 24 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor for use in an imaging system, comprising:	Page 46, DSP in FIG. 5	Items 6 and 7 of FIG. 1 and column 3, lines 32-35
a control input for receiving a signal representing a selection of a portion of an image having the properties of a circular field-of-view	Pages 47 and 51; Page 35 (fisheye lens); it is well known that the perfect fisheye lens has an infinite depth-of field	FIG. 1, column 3, lines 39-43 and column 4, lines 10-21; Column 5, lines 13-17

being substantially in focus, wherein said selection is chosen across said field-of-view; and		
a converter, responsive to the control input, for converting stored digital data representing the selected portion to digital data representing a perspective-corrected image for display.	Page 53 (Algorithm Processor Block) and page 46 (FIG. 5)	Column 3, lines 32-43 and column 4, lines 48-53

Claim 25 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A memory for a signal processor, comprising	Pages 40 and 41	
a data structure, responsive to a control input representing a selection of a portion of an image stored in said memory, wherein said selection is chosen across said field of view, said data structure representing an orthogonal set of transformation algorithms; and	Pages 40 and 41 Page 53 (Algorithm Processor Block) and page 46 (FIG. 5)	See Equations 1-19 at columns 5 through 7
a buffer memory adapted to store digital image data for transformation	Page 41	See item 4 in Fig. 1 and column 3, lines 30-32.

Claim 27 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A memory for a signal processor, comprising	Pages 40 and 41	
a data structure, responsive to a control input representing a selection of a portion of an image, said data structure representing an orthogonal set of transformation algorithms.	Page 53 (Algorithm Processor Block) and page 46 (FIG. 5)	See Equations 1-19 at columns 5 through 7

Claim 28 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A signal processor for converting digital images, comprising:	Page 46, DSP in FIG. 5	Items 6 and 7 of FIG. 1 and column 3, lines 32-35
a memory for storing digital data representing an input image having the properties of a circular field-of-view and objects in the field-of-view being substantially in focus,	Page 45 and 46 (FIG. 5, CCD Frame Buffer)	Item 4 in Fig. 1, column 3, lines 30-31 and column 5, lines 13-17.
a control input for receiving a signal representing a selection of a portion of the input image, wherein said selection is chosen from across said field-of-view, and	Pages 47 and 51	FIG. 1 and column 4, lines 10-21
a digital converter, responsive to said control input, for converting stored digital data in said memory representing the selected portion of the input image into digital data representing a perspective-corrected image, wherein said planar image is one of a panned, tilted, rotated and magnified version of the input image.	Page 53 (Algorithm Processor Block) and page 46 (FIG. 5)	Column 3, lines 32-48 and column 4, lines 48-53

Claim 29 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The signal processor of claim 28, further comprising image capture means, coupled to said memory, for continuously capturing said input image and storing it into said memory, wherein said digital converter continuously converts said digital data into said perspective-corrected image.	Pages 6, page 45 (fisheye equipped CCD camera) and 46 (DSP, image conversion block, CCD frame buffer camera interface) Page 41, lines 23-25	Item 3 in FIG. 1. Column 4, lines 44-47

Claim 30 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The signal processor of claim 29, wherein said image capture means comprises a fish-eye lens.	Page 6	Item 1 in FIG. 1.

Claim 31 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The signal processor of claim 29, further comprising a second memory, coupled to said digital converter, for storing said perspective-corrected image.	Page 46, CCD frame buffer camera interface, data compression block, compressed data hold buffer.	Item 9 of FIG. 1

Claim 38 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method for displaying a portion of an image, the image having a field of view greater than or equal to 180 degrees, the method comprising the steps of:	Pages 39-40	Abstract and column 2, lines 36-59.
capturing digital data representing at least some of the image;	Pages 45-46	Column 3, lines 28-32.
receiving an input of at least one selected portion of the at least some of the digital data; and	Page 54	Column 2, lines 48-59.
converting the at least one selected portion to a perspective corrected image in real-time in response to and based on information included in the input.	Pages 44 and 53-54	Column 3, lines 37-48.

Claim 39 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The method as recited in claim 38, wherein the input is a designation of a magnification.	Pages 6 and 39-40.	Column 8, lines 5-8

Claim 40 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The method as recited in claim 39, wherein the input is a designation of a viewing angle.	Pages 47 and 51	Column 3, lines 39-43

Claim 41 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The method as recited in claim 40, the input is a sequential set of inputs.	Page 51	Column 3, lines 39-43

Claim 42 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The method as recited in claim 40, the input is a sequential set of inputs from a joystick.	Page 6	Column 3, lines 39-43.

Claim 43 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The method as recited in claim 40, the input is a sequential set of inputs from a computer.	Page 54	Column 3, lines 39-43.

Claim 44 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The method as recited in claim 38, the image having properties of a circular field-of view.	Page 35, lines 30-33 (fisheye lens);	Item 1 (fisheye lens) FIG. 1

Claim 45 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The method as recited in claim 38, the image having properties of a hemispherical field-of-view.	Page 39, lines 13-16 (fisheye circular image); Page 21, lines 17-19.	Abstract and column 2, lines 36-40.

Claim 46 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
Apparatus for displaying a portion of an image, the image having a field of view greater than or equal to 180 degrees, the apparatus comprising:	Pages 39-40	Abstract and column 2, lines 36-59.
image capturing means for capturing digital data representing at least some of the image;	Pages 45-46	Column 3, lines 28-32.
input means for receiving an input of at least one selected portion of the at least some of the digital data; and	Page 54	Column 2, lines 48-59.
converter means for converting the at least one selected portion to a perspective corrected image in real-time in response to and based on information included in the input.	Pages 44 and 53-54	Column 3, lines 37-48.

Claim 47 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
Apparatus for displaying a portion of an image, the image having a field of view greater than or equal to 180 degrees, the apparatus comprising:	Pages 39-40	Abstract and column 2, lines 36-59.
a lens for capturing digital data representing at least some of the image;	Page 6	Item 1 in FIG. 1
a joystick for inputting at least one selected portion of the at least some of the	Page 6	Column 3, lines 39-43.

digital data; and		
a converter for converting the at least one selected portion to a perspective corrected image in real-time in response to and based on information included in the input.	Pages 44 and 53-54	Column 3, lines 37-48.

Claim 48 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
A method for obtaining a wide-angle image, the wide angle image having a field of view greater than 180 degrees, the method comprising the steps of:	Page 5	Abstract and column 2, lines 36-59.
capturing the wide-angle image;	Pages 45 and 46 (FIG. 5, CCD Frame Buffer)	Image buffer 4 of FIG. 1, column 3, lines 30-32, and column 5, lines 13-17
storing the wide-angle image in a format for subsequent display, said format being capable of transformation from said wide-angle image to a perspective-corrected image in real-time responsive to and based on information included in an input.	Pages 45 and 46 (FIG. 5, CCD Frame Buffer)	Image buffer 4 of FIG. 1, column 3, lines 30-43.

Claim 49 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
Apparatus for providing a wide-angle image, the wide angle image having a field of view greater than or equal to 180 degrees, the apparatus comprising:	Page 38	Abstract and column 2, lines 36-59.
a lens for capturing the wide-angle image;	Page 6	Item 1 in FIG. 1
a memory for storing the wide-angle image in a format for subsequent display, said format being capable of transformation from said wide-angle image to a perspective-corrected image in real time responsive to and based on information included in an input.	Pages 45 and 46 (FIG. 5, CCD Frame Buffer)	Image buffer 4 of FIG. 1, column 3, lines 30-43.

Claim 50 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The signal processor of claim 1, wherein the control input provides input information regarding a desired level of magnification.	Pages 6 and 39-40.	Column 8, lines 5-8

Claim 51 recitation	Where found in Exhibit A	Where found in U.S. Patent 5,185,667
The signal processor of claim 1, wherein the control input provides input information regarding an orientation angle.	Pages 6 and 39-40.	Column 8, lines 5-8

6. Attached as Exhibit B are monthly Status Reports, which I drafted, showing the progress made on the Omniview Motionless Camera Orientation System. The Status Reports show the progress that was made from May, 1990, the month that the Kurahashi reference was published, until May, 1991, the month that U.S. Patent 5,185,667 was filed in the U.S. Patent and Trademark Office.
7. The present application contains at least all of the disclosure of priority application U.S. Patent 5,185,667. Therefore, the present application provides support for the above claims.
8. The statements made herein are of my own knowledge and all statements made on information and belief and are believed to be true. These statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Steven D. Zimmerman

Date 8.13.01

ATTACHMENTS

1) Exhibit A - SBIR Proposal Materials
2) Exhibit B - Status Reports
3) Copy of U.S. Patent 5,185,667